Wii GAME TECHNOLOGY FOR MUSIC THERAPY : A FIRST EXPERIMENT WITH CHILDREN SUFFERING FROM BEHAVIORAL DISORDERS

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ABSTRACT

We present a first, proof-of-concept experiment of the MAWii music therapy system, which uses Wiimotes as virtual instruments. This experiment involves four groups of children suffering from behavioral disorders and currently treated in a day hospital in Paris. Preliminary analysis shows that the system is robust, that patients were strongly motivated by it and that their behaviors and verbal expressions had rich psychodynamic content. Future work will entail further experimentation to explore new venues for game technology in music therapy, to assess the therapeutic value of our approach and to automatically extract pertinent data from therapy session recordings.

KEYWORDS

Group music therapy, behavioral disorders, serious games, Wiimote, motivation

1. INTRODUCTION

Serious games have been used successfully in many different fields such as education, advertising, training simulations and, more recently, health care. We decided to try to apply this approach in a field of psychology often reluctant to use electronic devices and computers, namely music therapy (Streeter, 2007), using the new human-computer interfaces that game hardware manufacturers have recently been releasing.

Music therapy patients are invited to listen, play, sing or compose music, depending on the technique used (Bruscia, 1991). We focus here on active music therapy where patients, alone with the therapist or in a group, improvise music using usually simple instruments such as cymbals, djembes, maracas and many others. In addition to the pleasure of playing, which is of importance for patients who often have severe conditions that prevent them from enjoying common distractions, such an activity has several potential benefits including better motor coordination (Bruscia, 1991), improved social interaction and ability to express feelings that otherwise would never have come out (Lecourt, 2007).

Computer technology has been invading most health-related fields for quite some time now but, although several promising attempts were made to improve music therapy sessions using computers, none of the previous systems really managed to get out of the lab, most likely due to impracticality issues (Streeter, 2007). Building on this body of work, we identified several directions in which we think a video game technology-based approach can improve music therapy: patient motivation, control and sound customization

to better fit patients and computer-assisted analysis of session recordings. The overall goal of our research is thus to assess the potential benefits one can get from using advanced video game technology in music therapy along these lines.

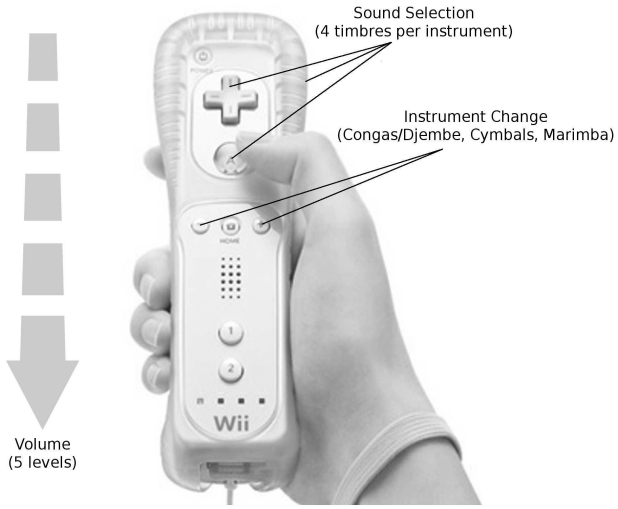
We decided, as a first step within this multifaceted project, to replace traditional music instruments with the Wiimote haptic devices designed by Nintendo for its Wii video game system, use them to generate sounds and measure the corresponding impact on the therapeutic process. We present here our MAWii prototype system and its first field test with patients currently treated by traditional music therapy. We explain how it was designed in collaboration with music therapy researchers to be suitable for instable/impulsive children. We then analyze the results of our proof-of-concept experiment, suggest future work and conclude with the long-term goal of our research.

2. MAWii SYSTEM DESIGN

We designed a Wiimote-control-to-sound mapping that mimics the percussions the children have been using in previous sessions. Each patient uses two Wiimotes and, by performing downward strokes, triggers percussive sounds the volume of which is linked to the stroke force (we found that 5 volume levels were a good choice). For interaction data communication and processing, our MAWii system uses Bluetooth and Karl Kenner's Glovepie scripting language to interface the Wiimotes with a standard PC running Steinberg Cubase under Windows. Sounds triggered by Wiimote movements, detected by its three accelerometers, are generated by a Roland XV-2020 MIDI synthesizer.

We limited the number of instruments to three (Buttons + and - are used to circle through them). Both Wiimotes correspond to the same instrument; A, B and the D-pad are used, on each Wiimote, to choose one among the four sounds available for each instrument, as shown in Figure 1 (if no buttons are pressed, a default sound is played).

Figure 1 (Picture modified from www.nintendo.com).
MAWii UI for sound generation using Wiimotes (2 per patient)



To select the sound palette, we decided that all three instruments had to have very different personalities in order to encourage the children to explore and to help them distinguish their own production from that of the others. On the contrary, the four timbres within one instrument had to have similar characteristics in order to maintain a sense of consistency between the two hands and yet remain easily distinguishable from one another to avoid the frustration of pressing buttons with no apparent musical result. We thus created three composite instruments that fit these constraints: (1) a combination of congas and djembe (two sounds each), (2) a set of four cymbals and (3) a marimba with four pitches (C as root and its major third, fifth and octave).

Of course, this choice of sounds is highly dependent on the hardware used to generate them. The Roland XV-2020 turned out to be a bit limited, which is why we had to mix djembe and conga sounds in one instrument. Even though the sounds cannot compare to those of the real instruments, we hoped that the children would not mind and would still engage willfully in an interesting creative process, being as used to synthetic video game sounds as they usually are.

3. EXPERIMENT SETTING

The experiment took place in Paris at a day mental-health hospital for socialized but instable children. Every evening, for about two hours and on a voluntary basis, they may participate in various activities organized by the staff. Music therapy takes place in a separate room and, although the children may choose to come or not depending on how they feel that day, they must do so at a given time to always play with the same group.

The therapist uses an adaptation of the Sonorous Communication technique introduced by E. Lecourt (Paris V University) (Lecourt, 2007). Using the instrument of their choice, the patients improvise freely as a group during a short period of time. Then, they listen to the recording of their performance to elaborate verbally about what they felt while playing, what the music inspires them or anything else they feel like saying. An ambiance microphone, unknown to the patients, records the whole session.

The sessions have five phases: welcome, improvisation, first elaboration, recording play and second elaboration. The therapist silently watches the improvisation and then guides the elaboration, taking notes for evaluation according to a custom list of items which deal with both individual and group processes. Although the improvisation phase does provide clues, in Sonorous Communication it should be seen more as a support for elaboration and symbolization than as a therapeutic process in itself (Lecourt, 2007). One of our research goals with this replacement of traditional instruments by Wiimotes is thus to make the improvisation phase richer and more enjoyable, but not necessarily more "therapeutic", which would have moved us closer to a cognitive/behavioral approach (see Luce, 2001).

Four sessions were scheduled for our experiment, involving four existing patient groups composed of up to four children, all suffering from instability: (1) one girl aged 7 (one patient was missing, but the protocol asks for no change); (2) two boys aged 8 and 10; (3) one girl aged 10 and one boy aged 10; (4) one girl aged 10.

4. RESULTS

The experiment goal was to show the adequacy of our game-based approach to the music therapy processes. We describe below positive preliminary findings related to cultural acceptance, motivation via enhanced usability, and psychodynamic impacts. Note that the system designers were not allowed to participate in the actual experiment to prevent interference with the ongoing medical treatment, and that the results reported below come from listening to session recordings and interviews with the music therapist.

4.1 Cultural acceptance

Music in itself is not therapeutic; what the children express about their performance is what matters. One aim of our system was thus to get the children involved in the music production process as deeply as possible so that they elaborate richly afterwards. Here, the experiment is a great success; the children showed significant motivation to experiment and play with the system, and this for at least three reasons: self-esteem, technology and capability.

Firstly, the children felt important when the therapist told them they were going to participate in an experiment: an "instrument designer" wanted their opinion on a new instrument especially crafted for them. After improvising, when asked what they would add or change and how they would name the system, they said (translated from French): "*What can we change?*", "*Add a guitar*", "*Add colors*", "*Remove this button; it*

is useless", "*Call it Degeneration X*", etc. Beside suggesting improvements for our system, these statements can be very interesting for the therapist, especially when coming from children who usually have a hard time reflecting on what they feel and communicating it.

Secondly, the use of a gaming device such as the Wiimote is extremely appealing to the children. Those who already knew about it (four out of six) were excited by the fun and "hip" feeling it carries and had very enthusiastic first reactions when shown the setup: "*Whoa, the Wii!*", "*[The system designers] chose a sort of Gameboy to attract the children, and when they hear it they will be even more attracted*", "*Thanks for the Wiis; it's like on TV*". Those not familiar with video games (two out of six) were more attracted by the novelty of the experience: "*What is it? It's magic!*", "*What can I do with it?*".

Thirdly, the children understood that the instrument had more capabilities than the ones they were used to. With the Wiimotes, any kind of sound can be chosen: "*There are several musics!*", "*Call it the Catalogue*", "*Where is my derbuka?*". This last reaction is especially interesting: naturally, the children's cultural background (the girl saying this comes from North Africa) influences their taste in sound. Therefore, being able to use any kind of synthetic sound can help the therapist get the patients involved by offering them the sound that really moves them, like the derbuka for this girl.

4.2 Usability

Our Wiimote-based instrument offers twelve different sounds (three instruments with four sounds each), which is quite a lot for a music therapy instrument. Previous informal testing had suggested that children might encounter some difficulties while navigating between these various sounds, even if the therapist demonstrated the selection mechanism beforehand. It turns out that none of the patients really seemed to understand the difference between switching instruments and changing sounds within an instrument. In their mind, pressing a button just modified the sound, but this may change with more practice.

For reasons linked to our relying on acceleration only, a single stroke can sometimes trigger two sounds. Although lowering the device sensitivity could have fixed this, the therapist thought that triggering sounds with very small movements would encourage the children to better control themselves, which is an important treatment goal here. It turns out that none of the patients complained about this issue, nor, for that matter, about any aspect of the sound triggering mechanism. Group 2 even engaged in a common exploration of the various volumes available: "*You changed the volume*", "*You are playing too loud*" (while playing).

The children even used the system in ways we did not expect. As a hardcore Wii gamer would have done, they figured out that it was not necessary to mimic an actual percussion stroke to trigger a sound. The girl in Group 1 took advantage of this to dance while playing and Group 3 explored several ways to use the Wiimote (over the head, upside-down etc.) : "*Here*, *I'm doing it with the wrist*". Interestingly, this shows that what could be seen as a problem within a classical game can turn into an asset in a music therapy setting. The children, eager to "bend the rules", explored a type of freedom that no traditional instrument could give them.

4.3 Psychodynamic processes

Our experiment led to many positive individual observations. Most likely for motivational reasons linked to the system novelty, all the children behaved well and properly followed the instructions. No destructive acts were observed, which is a marked improvement over previous sessions. Moreover, several children made symbolic observations: "*It sounds like it's running*", "*I'm playing like a beating heart*" or "*I'm like a real musician on TV*". We see that the lack of corporality of the Wiimotes (no vibration, synthetic and non-localized sound, plastic feel, etc.) did not prevent the children from building their own meaning and symbols.

For group interactions, we can only make relevant observations related to Groups 2 and 3, since Groups 1 and 4 were not really groups. Both groups managed to establish a clear common pulse and started to explore, each in a different way. Group 2 engaged in a joint exploration of volume, following each other in series of crescendi and decrescendi with a distinct polyrhythmic pattern, while Group 3 focused on "tricking" the system, showing each other different techniques. Interpreting such processes is hard (Wosch and Wigram, 2008), but they are clear signs of improvement for children who have trouble socializing within a group.

Moreover, our system added a little twist to standard music therapy sessions that proved very interesting for the therapist. Traditional music instruments produce their sound themselves, while here all the sounds were coming from the speakers. Furthermore, all the children had access to the same set of instruments at the same time. Thus appeared for them the new need to separate their production from that of the others. Most children managed to do so by looking at the others (therapist or partner) to see when they were playing. However, in Group 2, which was the most musically advanced, the children put the instrument change to use, although it was accidental; one child said "*That's me!*" and kept the instrument he just had found, taking a lot of pleasure in expressing his recovered individuality and in turn drawing his partner on the same track.

5. FUTURE WORK

Future work will involve the computer-assisted analysis of MIDI recordings, using tools such as the MTTB (Erkkilä et al., 2004) to extract information such as tempo or patterns, the psychodynamic study of the relationship between MIDI events and patient movements, as measured by the Wiimote accelerometers, and the possible addition of new types of controls that will mimic other instruments or simply create new ones from scratch.

We will use new data gathered in two different upcoming experiments. The first one will be a year-long test with children suffering from behavioral disorders in order to compare the therapeutic value of our system with that of traditional instruments. We will analyze the evolution of the children's interest and see how we can renew it by suggesting new personalized sounds designed using the virtually infinite capabilities of modern software sound synthesizers. A base test with a control group will also be conducted.

The second experiment will be carried out with E. Lecourt's final year music therapy students at Paris V University. By collaboratively designing new instrument control schemes that therapists would use with their patients, we intend to establish a set of guidelines for creating and customizing instruments according to the patients' and therapists' wishes.

6. CONCLUSION

We presented the first field experiment of our MAWii music therapy system, which proved to be robust, appealing to patients and of clear potential therapeutic value, spurring both individual and group positive processes. Since such processes are at the core of Sonorous Communication, had we not noticed both types, we would have had to seriously reexamine our approach.

These promising results encourage us to work towards one of our long-term research goals: the design of a tool to help music therapists perform their patients' Psychomusical Assessment (Verdeau-Pailles, 1988) by probing their *Sonorous History* (Lecourt, 1985) through the collaborative creation of their very own digital instrument, which could then be modified throughout the whole treatment, thus providing a new view of the patients' progress during treatment.

REFERENCES

Bruscia, 1991. *Case Studies in Music Therapy.* Barcelona Publishers, Barcelona, Spain.

Erkkilä et al., 2004. Intelligent Music Systems in Music Therapy. *In Music Therapy Today (online),* Vol V, Issue 5.

Lecourt, 1987. L'enveloppe musicale. *In Les enveloppes psychiques,* pp. 199-222, Dunod, Paris, France.

Lecourt, 2007. *La Musicothérapie analytique de groupe.* Fuzeau, Courlay, France.

Luce, 2001. Cognitive Therapy and Music Therapy. *In Music Therapy Perspectives,* Vol. 19, No. 2 pp. 96–103.

Streeter, 2007. *Reactions and Responses from the Music Therapy Community to the Growth of Computers and Technology - Some Preliminary Thoughts.* Voices: A World Forum for Music Therapy (www.voices.no).

Verdeau-Pailles J, 1988. *Le Bilan psychomusical.* Fuzeau, Courlay, France.

Wosch and Wigram, 2008. *Microanalysis in Music Therapy.* Jessica Kingsley Publishers, London, UK.